

Plant protection

Organic agriculture is often interpreted as simply the substitution of synthetic pesticides with those permitted by regulations. Soil fertility and rotation, however, already examined in connection with plant nutrition and water management, are also fundamental in the management of pests and diseases. The importance of the complexity of agrosystems in phytosanitary control, too often overlooked, should also be emphasized.

Phytosanitary protection

In organic agriculture, there are three main principles of phytosanitary protection of crops: a) fertility and health of the soil; b) agricultural practices; and c) timing of the intervention. Good knowledge of the fields, soil characteristics, weather conditions and seasons which affect the farm are also important and necessary technical devices. At least once a week, the organic farmer must physically be in his fields and he must know how to observe crops.

As already mentioned, control of the principal cultural adversities is based on prevention through correct agricultural practices. A farmer with no experience in organic agriculture must not, during the conversion period, fall into the trap of substituting synthetic chemical products used in conventional agriculture with the corresponding organic or mineral products permitted in this type of cultivation. This is not actually the concept of organic agriculture and is incorrect.

Prevention of the principal cryptogamic diseases and harmful insects begins, first of all, with a good crop rotation system and correctly balanced fertilization in healthy soil adequately supplied with organic matter.

Prevention

The first phase of prevention consists of choosing the species, varieties or rootstocks most suitable to the climate and the farm's general agricultural conditions. It is evidently best to choose local varieties, which usually have a greater intrinsic resistance to the principal pathogens and pests in the region. However, market demand must be ascertained before cultivation.

Particular attention must then be paid to the availability of healthy propagation material, since most pathogens develop through the use of infected seeds or seedlings. To avoid this risk, seeds can be disinfested by immersion in a 1% copper sulphate solution for ten minutes. It is also possible to dress the seeds by mixing them with copper carbonate.

Balanced organic fertilization

The presence of a good supply of organic matter is an indispensable condition to obtain a soil equilibrated in fertility and biodiversity. Many microorganisms exist in the soil to interfere, compete and at times prey on various pathogens and parasites in crops. Good organic fertility and a strong presence of macro- and micronutrients allows less exposure to stress, one of the main factors predisposing plants to fungal attack.

Finally, the contribution of composted organic matter with a C/N ratio between 8 and 12 appears to have positive effects on some root diseases and nematodes.

Soil cultivation

Soil cultivation greatly influences the incidence of plant diseases, as illustrated by the following examples:

1. Shredding and ploughing of crop residues eliminate a substrate potentially favourable to the rise of some fungal diseases like apple scab and peach leaf curl, or to the overwintering of some pests like the hazelnut borer and European corn borer.
2. Superficial ploughing exposes weed roots to air, destroying them, and uncovers numerous pests, exposing them to predatory birds.
3. Summer soil cultivation helps eliminate the elaterid population and reduce the presence of nematodes.
4. Shredding of crop residues quickens their decomposition or, better yet, the composting of organic matter.
5. Removal of crop residues helps interrupt the life cycle of certain pests (e.g. the carrot fly).
6. Elimination of infected fruits and other plant parts (e.g. mummified fruits, wood affected by oidium and moniliasis) which can function as a source of primary inocula the following year.

Rotation

In organic farms, rotation is the crucial factor for the control of weeds and soil-borne phytopathogens, including nematodes. The goal of rotation is to avoid “tiring” the soil while impeding the specialization of diseases and parasites in the crops. It has been demonstrated that monoculture causes an increase of cryptogamic diseases, the control of which through either mechanical or natural means is extremely difficult.

Regeneration or maintenance of an agro-ecosystem

An agro-ecosystem, with hedges, wooded areas, canals and grassland, ensures superior biodiversity in all components of life, from microorganisms to mammals, which rotate around the cultivated field. Greater biodiversity means a higher presence of useful entomofauna with parasitic and predator insects in addition to greater competition among soil microorganisms. Cases of infestation with fungi and bacteria are also present.

Once these conditions have been respected – that is, organic agriculture is being practised in the most complete and comprehensive sense – as a last resort, one can intervene with the anticryptogamic products authorized in organic agriculture (annex IIB of the Regulation CEE 2092/91) should a pathogen or harmful insect arise to cause economic damage to the crop.

Once treatment is necessary, it is useful to consider some factors which determine the efficiency of intervention with anticryptogamic agents. Such factors include:

- *Water quality.* Water of a slightly acidic reaction (such as rainwater) with a pH between 5.5 and 6 is recommended.
- *Technical characteristics of the sprayer.* This must always be perfectly efficient with well-regulated jets, adequate power, etc.
- *Development stage of the phytopathogens and meteorological information.* These two factors are fundamental for precise timing in application. Almost all fungicides used in organic agriculture act as preventive cover and thus must be present before cryptogamic pathogens develop.
- *Life cycle of insects.* The juvenile stage (larva or nymph) is usually the most sensitive to insecticides and controllable. Sometimes, when the hatching of the eggs is gradual, it is necessary to wait for all larvae to emerge or to repeat treatment after a short while.
- *Weather conditions.* In organic agriculture, the presence of certain weather conditions in order to execute treatment is extremely important. In fact, for many products, application during daylight hours is to be avoided while dusk or early morning is preferred. This is true mostly for photosensitive products such as pyrethrin, rotenone, and preparations made with

Bacillus thuringiensis or granulovirus.

- *State of the vegetation.* If vegetation is dense, with curled leaves or substances released by phytophagous insects (e.g. honeydew or cerulean excretions), inclusion of a hydrating agent is necessary to improve distribution.
- *Combination of products.* Combine products, knowing well the characteristics and incompatibilities of each.
- *Complementary measures.* Before and after treatment, adopt complementary agricultural measures, e.g. green pruning, removal of infested or dry plant parts, or the release of useful insects.